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09/990,049	11/21/2001	William Ford	282662US8X	1484

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EXAMINER	
NAFF, DAVID M	

ART UNIT	PAPER NUMBER
1657	

NOTIFICATION DATE	DELIVERY MODE
07/29/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	09/990,049	FORD ET AL.	
	Examiner	Art Unit	
	David M. Naff	1657	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *25-33,35-43,45 and 47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *25-33, 35-43, 45 and 47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

An amendment of 3/13/08 amended claims 25, 33 and 35-41, and canceled claim 34.

Claims examined on the merits are 25-33, 35-43, 45 and 47, which are all claims in the application.

Claim Objections

Claim 42 is objected to because of the following informalities: in line 1, should "of electronic circuit" be "or electronic circuit". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 25-33, 35-43, 45 and 47 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Description is not found in the specification of producing the claimed composite containing metal particles of only sub-nanometer size. The specification (page 15, line 7) discloses a total thickness between 3 nm and 6 nm. Since DNA is 2 nm thick (specification page 4, line 19), the metal particles will be 1-4 nm in size. A total thickness of between 2 nm and 6 nm is described (Example 6), and this will result in a metal particle size of 0 to 4 nm when DNA is 2 nm in size. No description is seen in the specification of controlling the process to produce metal particles of only sub-nanometer size. The specification indicates the DNA contains metal particles varying in size and the DNA contains metal particles that are both sub-

nanometer in size and greater than sub-nanometer in size, and the total thickness varies along the DNA strand. This is apparent form Figures 2-6, 13 and 14, which show total thickness of the metalized DNA varying along its length. The specification fails to support that all metal particles on the DNA are sub-nanometer in size, but rather that some metal particles are sub-nanometer size and other metal particles are of greater size.

Claim Rejections - 35 USC § 103

Claims 25-31, 33, 35-43, 45 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pompe et al (AR) in view of Singh et al (5,560,960) and Richter et al (AQ) for reasons in the previous office action of 9/13/07, and for reasons herein.

The claims are drawn to a process of producing a metal particle-nucleic acid composite containing metal particles by reacting a nucleic acid specific metal complex with a nucleic acid to produce a metal complex-nucleic acid conjugate, removing non-conjugated metal complexes and/or non-conjugated byproducts, and reacting the conjugate with a reducing agent to produce the metal particle-nucleic acid composite. The metal complex-nucleic acid conjugate is formed by the specific reacting of the nucleic acid specific metal complex with bases of the nucleic acid, the metal particle nucleic acid composite is catalytically active towards electroless metallisation, the metal particles in the composite are not visualized by atomic force microscopy, and the metal particles in the composite are sub-nanometer in size. Also claimed is a metal particle-nucleic acid composite resulting from the process, a process of making a nanowire by treating the composite by electroless deposition of metal, a nanowire resulting from the process, and a small-scale network of electronic circuit containing the nanowire.

Pompe et al disclose (page 1090, left col, second full paragraph) that Pt(II) and Pd(II) complexes such as cis-diamminedichloroplatinum attach to DNA bases to form stable monofunctional and bifunctional adducts. Further disclosed (third full paragraph of the left col) is

that the Pt-DNA bond is not broken during reduction, and that Pt(II) and Pd(II) complexes attached to DNA double chain can act as nucleation centers for the growth of metal clusters. Also disclosed is carrying out metallization of DNA by adding DNA to Pd salt solution followed by adding a reducing agent, and obtaining clusters on the DNA of 3 to 5 nm in diameter in a few seconds after adding the reducing agent (paragraph bridging the cols, page 1090). Further disclosed is that a wide spread of cluster size distribution occurs reaching from less than 1 nm to more than 20 nm (page 1086, right col, line 8 from the bottom), and obtaining an average size of 1.9 nm (page 1087, left col, lines 1-4).

Singh et al disclose (paragraph bridging cols 1 and 2) precipitating nanometer-sized metal particles from solution within vesicles made from polymerizable phospholipids. Polymerized phospholipids are formed and added to a electroless plating solution. Before the electroless plating solution is added, palladium or platinum is provided on the inside surface of vesicles to function as a catalyst (col 3, lines 44-64). To insure that metal particles form only on the inside surface, any metal on the exterior surface of the vesicle is removed such as by using a chelating agent and gel filtering, or by passing the vesicles through an ion exchange column. Singh et al further disclose (col 5, line 18) using cobalt, nickel or iron when producing metal nanoparticles by electroless plating.

Richter et al disclose (page 508 and 510) metallization of DNA similar to Pompe et al and disclose formation of clusters of 1-5 nm diameter on DNA (page 508, left col, third full paragraph).

It would have been obvious to attach cis-diamminedichloroplatinum to DNA as disclosed by Pompe et al, and then use a reducing agent to obtain DNA containing attached platinum metal catalysis for use in electroless deposition of metal on the DNA as suggested by Singh et al subjecting vesicles containing Pd or Pt to electroless metal deposition and as suggested by

Pompe et al carrying out metallization of DNA by treating a DNA solution with a Pd salt solution, and then adding a reducing agent to form metal clusters on the DNA. Removing any non-attached metal complex from the DNA before electroless metallization would have been obvious to prevent the non-attached metal complex from forming metal particles as suggested by Singh et al removing metal from the exterior of vesicles to prevent metal particles from being formed on the vesicles exterior surface. The objective of Pompe et al is to obtain metal clusters on the DNA and not at other places, and to accomplish this one would obviously have to remove non-attached metal complex before electroless metallization. Removing any non-conjugated by-products would have been obvious simply to prevent any possible inference with subsequent reactions. It would have been apparent from Richter et al that metal clusters of 1-5 nm diameter can be obtained, and it would have been obvious to produce clusters not thicker than DNA since this is an objective of Pompe et al (page 1090, left col, first full paragraph). Such clusters will not be capable of being visualized by atomic force microscopy. Additionally, Pompe et al disclose cluster sizes varying from less than 1 nm to above sub-nanometer, and a average size of 1.9 nm. This would result in the some clusters of less than 1 nm in size being present. Reacting DNA with cis-diamminedichloroplatinum as disclosed by Pompe et al followed by reducing as set forth above will inherently result in metallization of bases, and provide a metal nanoparticle active towards electroless metallization. When carrying out metallization of DNA as set forth above, it would have been obvious to form a nanowire since Pompe et al (page 1090, right col, lines 1-10) and Richter et al (paragraph bridging pages 508 and 509) obtain a nanowire. Using the nanowire in an electronic circuit would have been obvious since metal wires are conventionally used in such circuits. The metallization of Pompe et al and Richter et al is controlled since they disclose controlling the time of metallization to control the size of clusters. The use of cobalt, nickel or iron when producing metal nanoparticles by electroless

plating as disclosed by Singh et al would have suggested using a electroless plating solution as in claim 38.

Response to Arguments

The amendment urges that the references are not enables for metal particles in the composite being sub-nanometer in size. However, in view of Pompe et al disclosing size of clusters varying from less than 1 nanometer to above, and an average size of 1.9 nm, the references are enabled for the DNA containing some metal particles that are sub-nanometer. The present specification fails to establish that the invention results in a composite containing only metal particles that are sub-nanometer. The working examples in the specification do not show producing a composite containing only metal particles sub-nanometer in size. The specification indicates the composite contains metal particles that are both sub-nanometer and above sub-nanometer in size.

Claim Rejections - 35 USC § 103

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 25-31, 33, 35-43, 45 and 47 above, and further in view of Newsman et al (5,670,680) for reasons in the previous office action, and for reasons herein.

The claim requires a gaseous reducing agent.

Singh et al disclose using hydrogenation (col 4, line 57) for reducing metal ions to produce metals in a process of producing metal nanoparticles by electroless plating.

Newman et al disclose using hydrogen gas for hydrogenation in producing metal complexes.

It would have been obvious to use hydrogen gas as a reducing agent to reduce the metal of a conjugate of a metal complex and DNA disclosed by Pompe et al as suggested by Singh et al and Newman et al.

Response to Amendment

The amendments urge that the references do not suggest sub-nanometer metal particles. However, for reasons set forth above, such metal particles are obvious.

Double Patenting

Claims 25-33, 35-43, 45 and 47 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-32 of U.S. Patent 6,884,587 in view of Singh et al.

The claims of the patent require metallization of a nucleic acid to produce a metal nanoparticle-nucleic acid composite.

It would have been obvious in view of Singh et al for the type of reasons set forth above to remove non-conjugated metal complexes and/or non-conjugated by-products, if formed, before treatment with a reducing agent in the process of the copending application claims for metallization of DNA. The presence of extraneous metal complex or other by-products will obviously be a contaminant that can interfere with subsequent reactions.

Response to Arguments

The amendment urges that the patent claims and Singh et al do not disclose the features of the present claims. However, claim 5 of the patent encompasses a sub-nanometer metal particles size.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the

mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David M. Naff whose telephone number is 571-272-0920. The examiner can normally be reached on Monday-Friday 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon Weber can be reached on 571-272-0925. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David M. Naff/
Primary Examiner, Art Unit 1657

DMN
7/21/08